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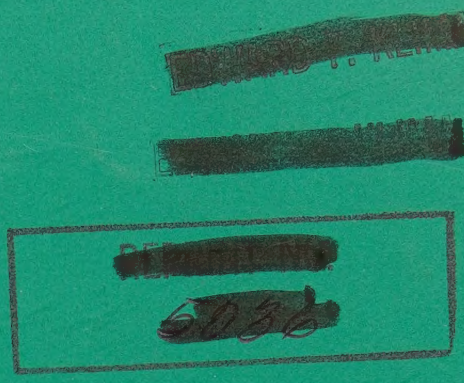

Report of the

TECHNICAL CONFERENCE ON FISH FINDING, PURSE SEINING AND AIMED TRAWLING

Reykjavik, 24—30 May 1970

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

REPORT OF THE TECHNICAL CONFERENCE ON FISH FINDING, PURSE SEINING AND AIMED TRAWLING

Reykjavik, 24 - 30 May 1970

Prepared by

Fishing Gear and Methods Branch
Fishery Industries Division
Department of Fisheries

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Summary of discussions, list of participants, list of documents presented.

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BACKGROUND AND ORGANIZATION

The first FAO Fishing Gear Congress held in Hamburg in 1957 was the first international effort at establishing fishing technology as a discipline. Consequently the agenda covered virtually all aspects of fishing gear and methods. The second Congress held in London in 1963 had also a very broad agenda although somewhat more restricted than the first one. The books resulting from these congresses, Modern Fishing Gear of the World Volume 1 (1959) and Volume 2 (1964) are major reference works on fishing technology and were published commercially by Fishing News (Books) Limited, London, and sold in thousands of copies throughout the world. Volume 1 was printed three times.

In 1970 seven years had elapsed since the holding of the last Gear Congress and in the interim there had been significant developments in the tools and techniques of search and capture of fish which FAO felt needed be reviewed at an international forum. This time it was decided to focus on fish finding, purse seining and aimed trawling since these were the areas of major technical advances in recent years. The Government of Iceland graciously offered to act as host, and the Conference was held in the Hotel Saga, Reykjavik, from 24 to 30 May 1970. It brought together 344 participants from 35 countries (Appendix IV). Invitations were sent out from the office of the Director-General of FAO to all FAO Member Governments. Invitations were also sent to the participants of the previous Fishing Gear and Fishing Boats Congresses, as well as to other FAO contacts known or expected to be interested in the subject matter. Several Press Releases were distributed to hundreds of fisheries periodicals throughout the world publicising the Conference and its agenda.

Selected authorities were invited to submit written contributions on the various subjects covered by the agenda (Appendix I). Eighty-seven papers (Appendix III) were accepted and printed for distribution to the participants to enable them to prepare themselves to contribute to the discussions and to the general exchange of information and experience. The papers were written in one of the FAO official languages (English, French or Spanish) and each contained an abstract in all three languages.

The success of the Conference was in a large measure due to the splendid support and cooperation extended by the Icelandic Government.

CONDUCT OF THE MEETING

The Conference was opened at 15:00 on Sunday, 24 May by His Excellency, Eggert G. Thorsteinsson, Minister of Fisheries of Iceland. The Mayor of Reykjavik, Mr. Geir Hallgrimsson, gave an address of welcome and Mr. H. Watzinger, Director of FAO Fishery Industries Division, spoke as the representative of the Director-General of FAO and introduced the Chairman of the Conference, Mr. David Olafsson, Governor of the Central Bank of Iceland and former Director of Fisheries (Appendix II). The opening ceremony was followed by a most interesting documentary film about Iceland, its nature and fisheries.

The Technical Conference started on Monday, 25 May and ended on Friday, 29 May. For the technical sessions a chairman and a rapporteur were appointed (Appendix I). In order to secure maximum time for discussions the presentation of the papers was included in the introductory review given by the rapporteur of the respective agenda item and only a minimum of time allowed to authors for additional explanations where considered essential.

On the Monday evening a reception was given at the Government Guest House by His Excellency the Minister of Fisheries and on Wednesday, 27 May, Conference participants were treated to an excursion to Thingvellir and Hveragerdi with lunch at Thingvellir as guests of the Fisheries Department, Federation of Icelandic Cooperative Societies, Icelandic Freezing Plants Corporation, Union of Icelandic Fish Producers, and Union of Stockfish Producers. On 26 and 27 May participants were invited to inspect the new Norwegian Fisheries Research Vessel G.O. SARS which came to Reykjavik on its maiden voyage, bringing several Norwegian participants. On Saturday 30 May guided visits were arranged for participants to inspect fishing vessels and equipment in Reykjavik harbour.

The papers and proceedings will be co-published in book form together with Fishing News (Books) Limited, London, as a companion volume to Modern Fishing Gear of the World, Volumes 1 and 2.

SUMMARY OF THE DISCUSSIONS

Location of fish and fishing grounds

The major part of unproductive sea time is spent looking for worthwhile concentrations of fish. Consequently improved efficiency in fishing operations depends largely on improving the ability to find the fish. Some major fishing nations such as Norway, Iceland, the U.S.S.R. and Japan have realized this and introduced fleet searching services often supported by Government-operated fish searching ships which usually coordinate radio communications among the fishing fleet. The specialized fish searching vessels often have on board biologists who make use of hydrographic and biological data as well as ship-to-ship and ship-to-shore radio communications. Forecasting environoment/fish relations is in a stage of development. This promises to be greatly enhanced by the forthcoming World Weather Watch organized by the World Meteorological Organization which will make available synoptic situation charts indicating sea surface temperature, wind and wave patterns, stratification depth, etc., and also anomaly computations comparing the present state of the sea with average years, as well as short, medium and long range forecasts of oceanic conditions. For the fishing industry it is essential that the knowledge of how to interpret and correlate fishing conditions with oceanographic conditions is improved and services are created for timely distribution of pertinent information. All this is likely to develop rapidly, including special charts showing environmental conditions in any area of interest to fisheries.

Visual spotting of fish schools is of importance in the U.S.A. menhaden purse seining, anchovy purse seining in Chile and in the U.S.A. tuna purse seining. This could possibly be employed more widely also for other pelagic fish schooling in or near the surface. In the U.S.A. underwater video observation of scallops has given promising results off the southeast coast. This technique could be used effectively for the survey of other bottom fauna where visibility is of the order of 3 meters or more.

Passive listening has been tested in several countries and particularly in Germany, Japan, the U.K. and U.S.A. but at the present time it does not seem to offer bright prospects as an aid to fish finding. However, the consensus of the Conference participants seemed to be in favour of continuing efforts in this field.

The major developments in echo sounding and sonar since the last Gear Congress in 1963 include the use of integrated circuits, high performance solid state components and lead zirkonate titanate ceramic transducers. Wireless netsonde equipment is used

predominantly in preference to cable netsonde in commercial fisheries. Time-varied-gain is now a feature available in some sounders and helps to interpret acoustic signals quantitatively. The use of integrated circuits promises to result in cheaper, more reliable and more sophisticated equipment for use in the rugged environment of fishing vessels.

Radio remote reading echo sounders or sonars offer some promise for purse seining and the operation of large setnets. Unmanned radio controlled buoys or even vessels seem to be within reach.

Computer simulation of echo records seems to be a practical aid to designing of equipment and also training of operators. The emergence of multi-stylus (or comb stylus) recording is a major technical development since the Gear Congress in 1963. Stabilized beam against the roll and pitching of the vessel is coming into use, especially in research vessels.

The need for simple tuning and easy to read display was stressed by several speakers.

For technical and financial reasons, of the three basic sonar types discussed the "searchlight" sonar with trainable and tiltable transducer is still the only one used in commercial fishing. The recent progress in electronic techniques which is expected to cut down the price of more sophisticated equipment may, in the foreseeable future, bring the within-pulse electronic sector scanning (WPESS) sonar within the reach of commercial application. The great potential of this sonar type with its radarlike part panoramic display and its high resolution for the improved observation of fish and gear was convincingly demonstrated by a film from the U.K. Since its working range is limited, it will probably not replace the conventional searchlight sonar, but become a valuable complement for purse seining and also trawling. The third type, the continuous transmission frequency modulated sonar, on the other hand will probably remain to be too expensive for fisheries.

As compared with echo sounding efficient sonar operation requires considerably more experience and skill. Consequently there is a need for specialized training to enable skippers to take full advantage. A working group was set up to discuss and recommend appropriate means and procedures of such training. It was generally agreed that sonar simulators could play an important part. In view of the costs involved international cooperation will probably be required.

Purse seining

About one-third of the world's catch of fish today is taken by purse seine, and since the potential catch of schooling pelagic fish is estimated at 50 to 60 million tons per year there appears to be a bright future for this type of fishing. Principal areas where major expansion of purse seine fishing appears promising include the eastern Pacific off the United States and Mexico, the Western Atlantic off Argentina, and the Arabian Sea.

Purse seining gear and methods vary considerably in the various fishing regions of the world; and these are largely a reflection of fish behaviour patterns and fishing conditions in the individual areas. The world's largest seine fishery is that for anchoveta off Peru. Annual catches exceed 10 million tons, all of which is used for fish meal. The vessels and gear employed are smaller than might be expected in such a large fishery. This is possible because of the excellent year-round sea conditions, close proximity to the fishing grounds and very high concentrations of fish

susceptible to capture with relatively shallow purse seines. Because catches are usually large and the fish very heavy, the seine is built with two or three bunts so the catch can be split into more easily handled segments. This is a technique developed originally for the tuna fishery of the eastern tropical Pacific.

Purse seine fishing for tuna started either in Japan or the United States and today it is the American fleet which leads the world in production of tuna with this method. Expansion of the fishery in the last 10-12 years to a world-wide operation using modern vessels up to 1,800 tons capacity is the direct result of the development of synthetic netting materials and the power block. The synthetic material enabled the construction of large seines and the power block afforded a means for handling the larger size and weight. This fishery is currently carried out in the tropical eastern Pacific and off West Africa. Tropical tuna occur in other areas but attempts to harvest them with purse seines have been largely unsuccessful to date. This appears to be the result of a much different behaviour pattern occurring in clear water with deep thermoclines and sufficient oxygen at greater depths.

In the North Atlantic, purse seine gear and methods have been highly developed in the herring, mackerel and capelin fisheries. Most noteworthy are the change-over from two-boat to one-boat operation with power block, synthetic netting materials and sonar guided fishing operations. The latter developed largely as a result of a change in fish distribution from surface to sub-surface and was dependent also on very deep seines and mechanical devices for hauling the heavy gear.

In the Mediterranean, the Philippines and Japan, pelagic fish are present but do not regularly occur naturally in schools large enough for purse seining. Artificial lights are therefore used to concentrate the fish into schools which permit economic fishing operations.

The world's largest purse seines are operated by the Japanese in some tuna fisheries. These are two-boat nets which reach a length of 2,300 m and a depth of 300 m.

There was much discussion on the relative merits of skiffs and side-thrusters as means for keeping the vessel out of the seine while pursing and hauling. It appears that, as usual, the fishermen adopt a system best suited to their specific operational conditions. In rough waters where seines with a high depth to length ratio are used, the thrusters have advantages. For a low depth/length ratio and reasonable weather and sea conditions, a skiff is preferable.

Materials for purse seines have seen few significant changes since the last Gear Congress. At the present, major purse seine fisheries in the Atlantic and eastern Pacific use nylon netting exclusively. The Japanese have taken a somewhat broader outlook and made rather extensive studies of various synthetic fibres. Generally the objective of Japanese seine design has been to achieve a heavier net for faster sinking by using netting of high density material such as vinylidene chloride, polyvinyl alcohol or polyester and even a combination twine made of nylon for strength and polyvinyl alcohol for weight. Nylon is used for smaller seines but in the larger seines the other materials are used in major sections of the nets.

In addition to utilizing netting material which assists in achieving a high sinking rate the Japanese also take advantage of the reduced water resistance of knotless netting. Both twisted and Raschel knotless netting are used in sections of the seine which take the least strain. Knotted netting is used in sections of high load such as selvedge strips and the bunt. Twisted knotless has the disadvantage of being difficult to repair and this is leading to increased use of the Raschel type in Japan.

Materials for mounting lines of purse seines have reached a degree of standardization regionally. In the eastern Pacific normal nylon ropes; in Scandinavia double lines of opposite lay of terylene, and in Japan vinylon, polypropylene and polyethylene lines are used.

The material problems encountered in purse seining as a result of fishing conditions are well documented. In the Japanese two-boat purse seine fishery off West Africa, the major problem was the different rates of stretching and shrinking of components during operations. After 92 sets the netting had shrunk 5 percent, the floatline had stretched 5 percent and the leadline had shrunk 25 percent. The result was a seine that had virtually ceased to fish. Although alterations were made by replacing some netting and rehanging, the original fishing performance of this 2325 m x 345 m seine could not be re-established.

Purse seine design is dictated almost entirely by the behaviour of the species sought and changes usually reflect either a change in behaviour pattern or new information on old patterns. An example of the former is the North Atlantic herring. Icelandic fishermen found the fish at progressively greater depths and had to increase the depth of their seines to take them. An example of the latter is the West African tuna which were found deeper than those of the eastern Pacific. The result was a larger and deeper seine.

To reduce the costs of full scale trials, studies have been made of American tuna purse seines using models to compare standard designs with modifications. The result was an improved net (the hybrid seine) which has later achieved significant catch increases. The major changes were: lighter netting, greater hang-in, tapered wings, floatline and leadline of equal length and a marked setback of main purse rings at both ends. The hybrid design sinks faster, fishes deeper and gives a better overall configuration in the water.

An experimental Icelandic seine which is designed to achieve faster and fuller pursing as well as improved handling has the unique feature of two leadlines, one about 10 fathoms above the other. The purpose is to achieve faster closing by getting the netting between the two leadlines horizontal early in the pursing operation. The upper leadline serves as a hinge which allows the lower section of netting to be more rapidly pursed. Another feature of this seine is tighter hang-in (ratio near 30 percent) which results in the most economic use of netting.

The slowest and most labour intensive operation in the purse seining cycle is hauling and stacking the net. A mechanical drum has been developed for this purpose which has proven very effective with relatively small seines and appears to be a promising method for handling large seines in some fisheries. The technique reduces crew requirements and speeds the hauling operation considerably. Disadvantages include difficulty of net repairs at sea, limitation of size of seine which can be handled, and difficulty in adjusting relative hauling speeds of float and leadlines.

The effect of vessel noise on fishing success is recognized but little understood. Experience suggests that fish respond to changes in noise levels rather than absolute levels and that they accommodate quickly to new levels.

Aimed trawling

The term "aimed trawling", which was originally attached to midwater trawling has been extended to trawling in general, including essential operational aspects such as gear selection and its adaptation to fishing conditions, instrumented control of gear performance in action and of the catching process as a whole.

Synthetics have meanwhile almost completely replaced natural materials for trawl gear. There is, however, no uniformity of opinion on the best choice which is due to the fact that economic considerations may play an important role. While in Japan polyethylene is vastly predominant, in most western countries polyamide is more common and in some fisheries is used exclusively. The same applies to the choice between knotted and knotless netting.

Advantages are expected from monofilament netting at least for certain parts of trawl nets, and practical tests appear to be underway in Japan and U.S.A. This implies certain manufacturing and repair problems while the handling of the stiffer and therefore more bulky material could probably be solved by using powered net drums.

Shape cutting of machine braided netting is quickly replacing hand braiding, except where manual labour is still cheap. Through the work of the International Standardization Organization the standardization of technical terms, testing methods and definition systems has made considerable progress, and coordinated efforts are continuing to further improve international communication.

A noteworthy development in trawl design is the widespread introduction of much larger meshsize of up to 1 m stretched in the front part. The resulting decrease in towing resistance enables a very considerable increase of the size of trawls which is of particular value for midwater trawling.

In spite of the fact that the importance of fish behaviour with regard to stimuli imposed by the gear and the vessel for the catching efficiency is generally recognised, still very little is known and the need for increased research efforts was strongly emphasized. This refers in particular to commercial fishing conditions for which tank tests may provide some guidance, but are certainly not sufficient. Apart from multi-netsonde observations, underwater television and direct observation by divers and from towed or free moving underwater vehicles will have to be employed.

In trawl gear research and development work the integrated approach was stressed which takes the best advantage of the compensating abilities of direct observation, instrumentation and model testing. The progress in instrumentation now provides measurements of such an amount and detail that electronic data logging and processing is required for efficient evaluation. Respective research systems, including software are being worked out, and it can be expected that shipborne computers will soon be standard equipment on fisheries research vessels. One line of approach towards an integrated trawling system may even lead to computer application on commercial trawlers in the foreseeable future.

In trawling the trawler and the gear are being considered as an integrated unit. Because of its comparatively high share in the overall investment, the selection of size and type of vessel to fit particular fishing conditions is of great economic significance. Attempts are being made to apply mathematical models and computers to the solution of this problem. There were, however, some doubts to what extent oversimplification of actual conditions may impare the accuracy of the results.

The progress in instrumentation for gear research and development work has already led to the introduction of some former research tools into commercial fishing, of which the netsonde was already a subject of discussion during the former Gear Conference. This has meanwhile been developed to multi-transducer systems, including at-the-net temperature observations and speed measurements. The extension of this technique from midwater to bottom trawling provides valuable means for improved gear control and

will hopefully soon find wider use. The introduction of "net sonar" i.e. multi-netsonde transducers directed forward from the net opening, improves the possibilities of counteracting fish school flight reactions and is expected to efficiently help in closing the gap between trawl and trawler in aimed trawling and as part of integrated trawling systems. Another example is the trawl warp meter which deserves wider commercial application than it has found so far. More sophisticated instrument systems for commercial trawling, including a more accurate determination of the amount of catch are being developed.

Trawl gear instrumentation requires reliable communication between trawl and trawler, for which a separate wire connection is basically superior over electrified warps or wireless links. Due to economic considerations at present wireless acoustic links for netsonde seem to be more common in some fisheries (e.g. Japan, Spain) than separate wire connections, but this may eventually change with increased data flow and, in particular, when the need for power supply and the transmission of orders from the trawler to the trawl will arise. In the near future it is expected that both wire and wireless links will continue to be used.

In order to improve fishing efficiency and to relieve trawler skippers from part of the increasing load of collecting and evaluating environmental fish and gear data for decision taking, a feasibility study of an instrumented and computerized integrated system for aimed trawling is being undertaken which will cope with suitable phases of fish searching, selection of targets, gear control and, in particular, the complex problem of interception between fish school and trawl under complicated conditions. This may be considered a first step towards more or less automated trawling.

There were strong arguments regarding the economic potentials of combination bottom and midwater trawls versus specialized trawl gear for bottom, semi-pelagic and pelagic fish. Without doubt a combination trawl would be preferable, but practical experience so far seems to indicate that such a gear could work only under specific and favourable conditions. In most instances the requirements are so different that specific trawl types are needed for rough, irregular and sloping bottom concentrating on ground fish, for reasonably smooth and flat bottom for ground fish and semi-pelagic fish and for truly pelagic fish. Consequently trawlers should be versatile for quick and convenient adaptation to varying fishing conditions. This can probably best be achieved by sterntrawlers with mechanized trawl drums.

Although trawl gear is now gradually increasing in size in better relation with the towing power, the "chasing" concept which requires trawling speeds equal or in excess of the swimming speed of fish still prevails. Practical experiences in herring midwater trawling in the north eastern Atlantic have demonstrated the potentials of the "outwitting" concept which is based on the avoidance of frightening the fish by towing large gear at low speed (two knots or less). Since the latter concept has obvious technical advantages, particularly for vessels with limited towing power, the investigation of its applicability to other fish species and fishing conditions would be indicated.

Aimed trawling with appropriate selection of essential and, at the same time, simple and reliable instrumentation and gear control is not restricted to large and expensive units nor to highly industrialized fisheries, but can also be applied in small vessel operation of developing fisheries.

Commercial aimed midwater trawling which was in the beginning restricted to truly pelagic species such as clupeoids, mackerel and horse mackerel, has recently been extended to roundfish species, which are semi-pelagic or pelagic only at certain times.

Examples are cod, saithe, pollock, hake, redfish. The one-boat technique has gained in importance in relation to the two-boat technique and reaches down to depths of 500 m and more. The area of the opening of midwater trawls for powerful trawlers has passed 2,000 sq.m. and along with this hydrofoil otterboards of 12 sq.m. each and more are in commercial use. The Süberkrüb type hydrofoil otterboard has found almost universal acceptance, and it is particularly noteworthy that in the Japanese fisheries after some modification this type of hydrofoil is now being used also for commercial bottom trawling. In addition to the design of net and rig a certain standardization has also developed with regard to acoustic equipment, including multi-netsonde and temperature measurement at the net.

The tendency towards larger nets has caused operational problems for the solution of which modifications of deck layout and additional auxiliaries are being developed, such as the two trawl technique with split working deck, more sophisticated multidrum or split trawl winches and mechanized net drums. Fish pumps have successfully been employed for dealing with large trawl catches. Electrical fishing in conjunction with trawls has still not reached the stage of commercial application, although there appears to be one system which is claimed to offer distinct possibilities.

Fishing in the future

The fact that a good number of forecasts made at the second Fishing Gear Congress have meanwhile come true, or are now within much closer range, indicates a considerable increase in speed of fishery development.

For approximately the next 10 years it is expected that several fish forecast centres based on international cooperation will be firmly established.

In the field of acoustic fish detection improved reliability, some increase in range and progress in signal processing, including computer evaluation of targets in regard to fish size, species and quantity are envisaged. In addition to these acoustic techniques and direct aerial scouting, the application of remote sensing systems using medium and high flying aircraft and, in particular, satellites for large scale and even worldwide monitoring of certain environmental phenomena (temperature, colour) will further develop and are expected to improve the location of certain fish resources and eventually lead to direct guidance for certain fisheries.

In purse seining the size of the nets is expected to further increase and better adaptation to behaviour characteristics of fish will lead to still more specific design patterns.

Progress in aimed trawling will probably be more in the fields of fishing tactics and gear control with regard to fish rather than major developments in gear construction and design.

An increase in tendency is expected from highly specialized single-purpose vessels towards multi-purpose vessels enabling the exploitation of various fish stocks under various fishing conditions, according to regions and seasons. Fish attraction systems, in particular with light and electricity, may lead to integrated industrial fishing systems. On the other hand under specific environmental and economic conditions fishing with old and almost obsolete gears such as traps and pots may be revived through streamlined and highly mechanized operations.

Continued and intensified investigations on the behaviour of fish in general and towards gear will provide more comprehensive information for the benefit of rational development of fishing methods and gear.

However, in spite of technical progress and computer automation the fishermen will certainly continue to be the irreplaceable key element in the effective exploitation of aquatic resources.

ACKNOWLEDGEMENTS

The Organization wishes to express its grateful appreciation to the Government of Iceland for graciously acting as Host to the Conference and for its excellent efficiency and cooperation in providing the most satisfactory facilities for the meeting and the secretariat.

The Ministry of Foreign Affairs and the Ministry of Fisheries generously extended their full support and assistance for the preparation and conduct of the Conference. Particular thanks are due to Mr. Mar Elisson, Director of Fisheries, Dr. Gunnar Schram of the Ministry of Foreign Affairs and the Icelandic secretarial staff who all contributed significantly to the smooth and efficient organization of the meeting.

Participants highly appreciated the generous hospitality offered by the Minister of Fisheries in the Government Guest House. Warmest thanks are also due to the Fisheries Department, the Federation of Icelandic Cooperative Societies, the Icelandic Freezing Plants Corporation, the Union of Icelandic Fish Producers and the Union of Stockfish Producers for the lunch offered to participants at Thingvellir. Many participants also gratefully accepted the invitation to inspect the new Norwegian research vessel G. O. SARS which came to Reykjavik on its maiden voyage.

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APPENDIX I

AGENDA, TIMETABLE AND OFFICERS

Conference Chairman: D. Olafsson
Vice-Chairman: A. v. Brandt

SUNDAY, 24 MAY

15:00	**Opening Ceremony in the University Cinema**	

MONDAY, 25 MAY

I FISH FINDING

1 Location of fishing grounds

10:00-11:15	**1.1 Organized fleet searching and intelligence services; use of searching and support vessels to assist the fleet**	Chairman: D. Olafsson Rapporteur: T. Laevastu
	1.2 Use of hydrographic observations and data for fish location; forecasting of weather and sea conditions	Chairman: --ditto-- Rapporteur: --ditto--

2 Fish Detection

11:30-12:30	**2.1 Visual spotting from ship and aerial spotting**	Chairman: B. B. Parrish Rapporteur: M. Sams
	2.2 By acoustic equipment	
14:00-17:30	**2.2.1 Echo sounding**	Chairman: B. B. Parrish Rapporteurs: R. E. Craig S. Olsen
18:00	**Government Reception**	

TUESDAY, 26 MAY

09:00-10:30	2.2.2 Sonar	Chairman: L. Midttun Rapporteur: D. Tucker
	2.2.3 Selecting acoustic equipment	Chairman: L. Midttun Rapporteur: O. Nakken
	2.2.4 Training in the use of echo sounding and sonar	Chairman: --ditto-- Rapporteur: --ditto--

TUESDAY, 26 MAY (continued)

II PURSE SEINING

11:00-12:00 and 14:00-17:35	1	History and global review	Chairman: J. Jakobsson Rapporteur: H. Kristjonsson
	6	Description of major fisheries	Chairman: --ditto-- Rapporteur: --ditto--
17:35-18:00	2	Materials for purse seines	Chairman: R. F. Allen Rapporteur: F. Wathne

WEDNESDAY, 27 MAY

09:00-11:00	3	Net design and construction	Chairman: --ditto-- Rapporteur: --ditto--
11:00-18:00	Excursion to Thingvellir		

THURSDAY, 28 MAY

09:00-10:15	4	Purse winches, power blocks, net drums, and other auxiliary equipment	Chairman: R. F. Allen Rapporteur: G. Thorsteinsson
10:15-11:20	5	Effect of vessel noise in purse seining	Chairman: --ditto-- Rapporteur: --ditto--
	7	Trends and possibilities for future developments	Chairman: --ditto-- Rapporteur: --ditto--

III AIMED TRAWLING

11:30-11:50	1	History and global review	Chairman: A. v. Brandt Rapporteur: R. McNeely
11:50-12:15 and 14:00-14:45	2	Materials, specific requirements for bottom and midwater trawls	Chairman: --ditto-- Rapporteur: --ditto--
14:45-17:20	3	Trawl gear selection, design and construction in relation to fish behaviour, vessel power and fishing conditions	Chairman: --ditto-- Rapporteur: --ditto--
17:25-18:00	4	Selection and application of acoustics and other instrumentation	Chairman: A. R. Margetts Rapporteur: J. Schärfe

FRIDAY, 29 MAY

AIMED TRAWLING (continued)

09:00-10:00	4	Selection and application of acoustics and other instrumentation	Chairman: A. R. Margetts Rapporteur: J. Schärfe
10:00-10:45	5	Aimed bottom trawling techniques	Chairman: --ditto-- Rapporteur: --ditto--
	6	Aimed midwater trawling techniques	Chairman: --ditto-- Rapporteur: --ditto--
10:45-13:00 and 14:00-14:30	7	Description of established commercial fisheries	Chairman: C. A. Goodlad Rapporteur: R. Steinberg
14:45-15:45	8	Trends and possibilities for future developments	Chairman: C. A. Goodlad Rapporteur: P. Crewe
16:15-17:40	IV	FISHING IN THE FUTURE	Chairman and Rapporteur: D. L. Alverson
17:50	Closing Ceremony		

SATURDAY, 30 MAY

Guided visits to vessels in harbour

APPENDIX II

ADDRESSES AT THE OPENING CEREMONY

1. HIS EXCELLENCY, EGGERT G. THORSTEINSSON Minister of Fisheries
representing the Government of Iceland

Mr. Chairman, Your Honour, Mr. Watzinger, Ladies and Gentlemen:

It is both a pleasure and an honour for me to welcome you all here today on behalf of the Government of Iceland. This is the first time that a major United Nations conference has been held in this country. We find it both fitting and logical that this conference, such an important fisheries event, should now take place in Reykjavík.

You are all undoubtedly familiar with the fact that fishing plays an enormous role in the economy and national life of my country. It has rightly been said that we live by the sea and from the sea - more than probably any other independent nation in the world. For a long time the harvest from the sea has made up the bulk of our national income and nearly all of our foreign currency earnings. It may therefore truthfully be said that fishing is the mainstay of the Icelandic economy - indeed, its very foundation. And we feel sure that in the coming years the welfare of the Icelandic nation also will depend upon the harvest from the ocean.

During the last decade our fishing industry has rapidly grown in size. The reasons for this are of course many, but the main reason is better and more plentiful catches. These much larger catches are, however, not caused by the fact that there are now greater reserves of fish in the sea around Iceland. This is unfortunately not so. The main cause of these much larger catches is a more sophisticated fish-finding technique, which has enabled our fishermen to gain better results. We are therefore greatly indebted to the technical evolution that has taken place in this field and this is why we are particularly glad to welcome this conference to Iceland.

If we mention one or two concrete examples, I immediately think of the veritable revolution that took place in our fisheries when we started utilizing the power-block and the sonar in combination for fish-finding purposes; these two innovations were first used on a large scale by Icelandic fishermen. We know that the evolution in this field is rapid and it is therefore important to follow all the latest developments if one expects to keep abreast in these matters.

It is now an accepted fact that most of the fish stocks of the North Atlantic are fully utilized and some of them are already in decline. For all fishing nations this is a matter of grave concern. It is therefore of great importance that the fisheries in this part of the world be planned in a sensible, forward looking way and that the capital invested in the fishing sector be put to the fullest use. One has therefore to adapt fish-finding techniques to these particular circumstances, so as to be able to utilize the money invested in the fishing sector in the most sensible way.

During the past years the Government of Iceland has followed closely the activities of FAO, not least its valuable contribution in the field of fisheries development. FAO is the UN organization that employs the greatest number of Icelandic citizens, and I understand that most of them are engaged in various projects in the developing countries. We are glad to be able to contribute in this way, even if it is not on a very large scale. I would especially like to mention Mr. Hilmar Kristjónsson of the Fisheries Department, who is highly regarded in this country and has now so ably had a hand in planning this conference.

It is my sincere hope that this conference may prove to be an important step forward in the field of fish-finding and gear development, and I am sure that my countrymen will greatly profit by your discussions. May I wish you well in your important venture.

2. HIS HONOUR, GEIR HALLGRIMSSON Mayor of Reykjavík

Mr. Chairman, Your Excellency, Mr. Watzinger, Ladies and Gentlemen:

It is a pleasure and privilege to welcome you here today on behalf of the City of Reykjavík.

What gives a special emphasis to this greeting is that the fishing industry plays a major part in the life and employment of the people of Reykjavík, as well as in other parts of the country.

You may be aware that Reykjavík is the oldest settlement in Iceland. As the story goes it was indeed the first settler in Iceland who, by the act of the ancient gods, decided to build his home here. However many of us think that he was only obedient to his gods due to the fact that Reykjavík was endowed with a natural fine harbour, nearby fishing grounds and other assets valuable even to a primitive way of life and which, later on, we have been able to cultivate and make beneficial also for a more modern way of life.

Actually Reykjavík did not seriously start to grow until after the turn of this century when the first trawlers were brought to Iceland and sent to sea from Reykjavík. No other means of livelihood has meant so much to the growth of the city as the trawler industry until, especially after World War II, we developed more varied industrial enterprises. However, nobody knows better than our distinguished gathering here today that the fish which seems to swim innocently through the deep blue sea is indeed very erratic, his course and habits often being hard to predict or cope with.

We have certainly had fluctuations in the yearly quantity of our fish catch and although our 5,000 fishermen are the most productive in the world, we have experienced, for instance in a daily trawler catch, a difference between more than 20 tons and down to 5 tons during the last 10 years. This has resulted in the decline of the trawler industry so vital to this country and this city in particular.

Since the catch is going up again now we hope to be able to renew our trawler fleet as well as other fishing vessels both in this city and elsewhere in the country. It is therefore of immense importance for us to follow, learn, and initiate all the best in modern fishing methods in the hope of stabilizing our fishing industry, at the same time doing our best to conserve and manage rationally the fishing grounds around the country on which we still base most of our exports. This is why we, here in this city, find the convening of this conference on modern fishing methods such an important event, and this is why the delegates to this conference are indeed specially welcome visitors. We do hope that the results of the conference will contribute to the valuable activities of FAO in the field of fisheries development, not least in the third world where such knowledge is so sorely absent. It may prove to be of special value for the delegates to study these problems here in Iceland, where the direct link between rational fishing methods and the well being of the people is so evident and easily observed. May I therefore express the wish, on behalf of the City of Reykjavík, that your stay here may prove a fruitful one and the results of your deliberations a success in every respect.

3. H. WATZINGER Director, Fishery Industries Division, FAO

Your Excellency, Minister of Fisheries, Distinguished Major of Reykjavik, Delegates, Participants and Observers:

It is an honour and a great pleasure for me to address you on behalf of the Director-General of the Food and Agriculture Organization of the United Nations at the inauguration of the Technical Conference on Fish Finding, Purse Seining and Aimed Trawling. This is the third time that FAO has convened a Technical Conference of this kind; the first was a Gear Congress held in Hamburg in 1957, and the second was in London in 1963. The earlier Congresses covered all aspects of fishing technology; this one concentrates on topics of great actuality.

When FAO was established 25 years ago one of its main activities was to assemble and disseminate information by bringing together technical experts, research workers and fishery industry people from all parts of the world to meetings such as this. Some years later the concept of technical assistance gained general acceptance and FAO became an action oriented agency, as well as a clearing house for information. Today a large number of developing countries are receiving assistance from the United Nations Development Programme (UNDP) in conducting exploratory fishing, resource surveys and establishing training and research centres. Through its Department of Fisheries, FAO acts as Executing Agency for UNDP fisheries projects. These now number 42 and involve a total of 63 countries and territories. Approximately 400 internationally recruited personnel are included in these projects, and several thousand national counterpart staff work with the international staff.

Most UNDP/FAO assisted projects in fisheries are oriented towards exploratory fishing, fishermen's training, processing, marketing and industry development, although some are concerned with inland fisheries. Thirty-three research and exploratory fishing vessels are in operation, with 15 more to be added to the fleet under the programme, which is currently expending a total of about US dollars 25 million a year, about equally provided by UNDP and the host countries. The data from these operations are of great interest and value as a contribution to knowledge of fishing potential and resources. Much more could be said about this programme which has the dual purpose of improving technological skills and laying a base for industrial development.

I should point out that this Conference is limited to a review of the three main topics of recent development - as its title implies - and should not be considered a scientific meeting where new research findings are being presented. Authors, titles and papers, to a total of 87, have been selected to give the widest possible coverage for the period since the last Gear Congress in 1963. However, in spite of our efforts, it has not been possible to deal with the subjects as comprehensively as we would have liked and we are therefore relying on an active contribution by the participants in the discussion to compensate for any ommissions.

I wish to thank the Government of Iceland for having agreed to be Host Country for this Technical Conference and for so generously granting facilities and making arrangements for it. In view of the contribution Iceland has made to the technological development of fisheries during the post-war period, I am sure we are all coming here with special interest and consider it a very appropriate location for our discussions. We have followed the progress which has been achieved in giving answer to the particular problems of the fishery of this country through the use of advanced echo acoustic techniques in locating fish, application of power in handling gear, design of new-type purse seines and improvement of catching techniques which all together have resulted in a major contribution to the present high technical level of purse seining in the Northeast Atlantic.

I would now like to let the Chairman, Mr. David Olafsson, take over. He is an old friend of FAO, having participated at FAO Conferences, and is well-known in world fisheries circles for his important contributions to various fisheries meetings.

As I extend the Organization's thanks for your attendance today, I want to convey special greetings from Mr. Roy I. Jackson, Assistant Director-General for Fisheries, who wishes you every possible success in your deliberations.

Herewith I declare the Conference open.

4. D. OLAFSSON Chairman of the Conference

Your Excellency, Your Honour, Mr. Watzinger, Ladies and Gentlemen:

May I first be allowed to express my gratitude to the Representative of the Food and Agriculture Organization for the honour which has been bestowed upon me by nominating me to be Chairman of this Conference; I can only pray that with your good help I can fulfill the task which has been entrusted to me.

From time immemorial the mysteries of life in the sea have fascinated people living on the seashore who have turned to the sea for their food and livelihood. Fishing in the old days may also have been fascinating but it was certainly hazardous. The detecting and catching of the fish had to be carried out practically without any helping devices. To locate the fish, the fisherman had to decipher many different signs to be detected in the natural surroundings - the colour of the sea, the behaviour of seabirds or in some cases, which was of great advantage, the shoal was visible on the surface of the sea. Thus he might succeed in detecting the fish but he had no means by which he could follow the behaviour of the gear once it was in the sea nor the reaction of the fish to the gear used for catching.

That was where the oftmentioned sixth sense of the fisherman came in, his luck as it was also called, as is related in an eighteenth century book by two Icelandic naturalists describing fishing in Iceland at the time: "At the end of each fishing trip the catch is dealt out between the crew members in even lots for else the difference in lots might become too big depending on the luck of individuals." In the same book I find this remark about the fishing gear used at the time: "The most essential fishing gear for the fisherman are a good hook and a handline."

The handline and the hook are still useful under certain conditions though the technique in using them has advanced greatly, but this conference will show us the vast progress which has been made in fishing techniques, not only in the last 200 years but in the last 20 or even 10 years, and the prospects opening up for the future by the use of modern scientific methods in detecting fish and catching it.

At the beginning of this third FAO Conference in the field of fishing gear and fishing techniques my memory brings me back to the first conference in Hamburg in 1957. We were at that time standing on the threshold of a new era in catching techniques which were to revolutionize the herring fishing in the Northeast Atlantic. About the time when it became clear where this development would lead us, a good friend of mine, a famous scientist, once said to me: "I would not like to be a herring in the North Atlantic now." The meaning of these prophetic words seems to have become true, a great stock of herring in this area has been almost totally exterminated for the time being. But you must not misunderstand me, that I am putting the blame for this on the greatly advanced fishing technique; not at all. It is the old lesson over again where science and technology are outrunning the capability of man to control his own behaviour and human relations.

It is the task of the scientist and the fishing gear technologists to develop the gear and the technique resulting in the most effective catching at the lowest cost to the fisherman, but the administrator has to set the rules of the game whereby a sensible utilization of the resources is to be secured.

Ladies and gentlemen, we Icelanders often say that we are a small nation, and some of you may even find it difficult to understand how a nation of this size has been able to survive in this country for almost 1,100 years. By saying this, however, we are not deploring the fact. On the contrary, we have found out that being a small nation has many advantages.

In one field, however, Iceland can count itself among the big nations and that is in the field of fisheries. That is the reason why this conference is particularly welcome to Iceland and we feel greatly indebted to the Food and Agriculture Organization for holding it in this country.

Personally it is a great pleasure for me to be able to take a small part in this FAO Conference, having enjoyed connections with the Organization all the way back to 1946 when I had the pleasure of representing my country at the second FAO Conference held in Copenhagen that year. From that time I have followed the development of the work of the Organization mainly in the field of fisheries and I therefore feel justified in congratulating them on their achievements.

Finally, Delegates to this Conference, thinking back to the two previous conferences in this field, we are under a great obligation to the fishermen of the world. They are asking for the tools to carry out this vital task of securing for mankind food from the sea, with every-increasing efficiency. Let us hope we shall succeed.

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APPENDIX III

LIST OF DOCUMENTS

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2	Possibilities and trends for future development of sonar for fisheries	Tucker, D. G.
3	The automated fishing platform	Klima, E. F.
4	Synthetic net materials for bottom and midwater trawls	v. Brandt, A. Klust, G.
5	The Peruvian Eureka Programme; rapid acoustic surveys using fishing vessels	Villanueva, R.
6	Echo sounding - present status	Craig, R. E.
7	Temperature telemetry as an aid for fish finding	v. Seydlitz, H.
8	Video scallop assessment system	Seidel, W. R.
9	Southeastern Pacific aircraft-assisted purse seining	Sams, M.
10	Purse seine design and construction in relation to fish behaviour and fishing conditions	Iitaka, Y.
11	Synthetic fibres used in Japan for purse seines and trawls	Japan Chemical Fibres Association
12	Recent developments in the Peruvian anchoveta fishery	Hellevang, N.
13	The Icelandic herring search and information services	Jakobsson, J.
14	Review of present status of sonar equipment and its application	Vestnes, G.
15	Shore-based training of trawler officers	Bennett, R.

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* abstract only in English

FII : FF/70/16		Icelandic purse seines with double leadline - construction and experience	Thorsteinsson, G.
	17	Application of oceanographic and meteorological analyses/forecasts in fisheries	Laevastu, T. Johnson, J.
	18	Selecting acoustic equipment to suit particular fishing conditions	Simonsen Radio A.S.
	19	Research on telesounders (wireless remote control echo sounding)	Hashimoto, T. Maniwa, Y. Kato, M.
	20	Description of commercial Icelandic purse seines for herring, capelin and cod	Thorsteinsson, G.
	21	Instrumentation for fishing gear experiments	Lusz, L. D.
	22	Purse seine materials in Japan	Nakamura, M.
	23*	Semi-pelagic trawling for herring fishing	Maucorps, A. Portier, M.
	24	Deck layout and auxiliaries for handling midwater trawls	Karger, W.
	25*	Determination of semi-pelagic trawl and its rigging according to the power of the vessel, the behaviour of species sought and bottom conditions	Portier, M.
	26	Practical applications and limitations in the method of fish finding by passive listening	Freytag, G.
	27	Training in the use of echo sounder and sonar	Simonsen Radio A.S.
	28	Effect of vessel noise in purse seining	Maniwa, Y.
	29	The application of a digital computer simulation to aid in the evaluation of echo sounder design and performance	Suomala, Jr., J. B.
	30	The use of electronic aids in trawling	Drever, C. H. G.
	31	Preliminary results of acoustic/fishing surveys in West African coastal waters	Raitt, D. F. S. Losse, G. F. Schmidt, W. Hoff, I.

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FII : FF/70/32		Ropes for purse seines and bottom trawls	Honda, K.
	33	Research on the luring of fish schools by underwater sound	Hashimoto, T. Maniwa, Y.
	34	Multi-stylus echo recording	Tanaka, I.
	35	Technology and its impact on performance and definition of new fish detection equipment for deep sea trawlers	Mross, S. Purnhagen, H.
	36	New Dutch experiences in two-boat midwater trawling with medium sized sterntrawlers, and prospects of combination arrangements for trawling and seining	Minnee, J. F.
	37*	Note on the increase of catching performance in herring trawling	Maucorps, A. Portier, M.
	38	Development of echo counting systems for estimating fish stocks in Japan	Shibata, K. Nishimura, M. Aoyama, T. Yamanaka, I.
	39	Combination fishing vessels	Kristinsson, G. E.
	40	An evaluation of a CFTM sonar in fishery research	Yuen, H. S. H.
	41	Rotor device for controlling depth of towed fishing trawls	Smith, K. A. Stubbs, H. E.
	42	Experimental measurement of target strength of fish	Shibata, K.
	43	Clupeid fisheries in the tropical Eastern Atlantic	Dykhuizen, P. Zei, M.
	44	Two-boat bottom and midwater trawling	Steinberg, R.
	45	A fish detection echo sounding system with an electronically stabilized narrow beam and bottom locked display	Pearce, G. Philpott, S.
	46*	Notes on herring mid-water trawling and sonar utilization	Calon, L.

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	48	The purse seine fishery in Japan	Akaoka, T.
	49	Studies on automation of fishing with otter trawls, Danish seines, midwater trawls, and purse seines; design criteria for a midwater type purse seine	Hamuro, C.
	50	New types of multi-netsonde equipment	Horn, W.
	51	Sound beam stabilization for echo sounding and sonar	Miyajima, J.
	52	Noise and vibration aspects of fishing vessel design	Doust, D. J. Logan, J.
	53	Behaviour patterns of different herring stocks in relation to ship and midwater trawl	Mohr, H.
	54	A fish counter for use in commercial fishing	Hearn, P. J.
	55	Deck equipment for purse seining	Bårdarson, H. R.
	56	Anchoita purse seining experiments off Argentina in 1969	Gudmundsson, T. Gamberale, A.
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	58	Light attraction in Japanese fisheries	Miyazaki, C.
	59	Japanese tuna purse seining off West Africa	Sugano, S. Yamamura, S.
	60	Trawling gear in Japan	Nakamura, M.
	61*	Experiences in midwater trawling off Argentina	Okonski, S. L. Martini, L. W.
	62	Comparative efficiency of nylon monofilament and polyethylene monofilament netting for small otter trawls	Miyazaki, C. Tawara, Y. Yokoi, T.
	63	Influence of vessel noise on behaviour of herring	Olsen, K.

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* abstract only in English

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	65	A calculation method for matching trawl gear to towing power of trawlers	Koyama, T.
	66	Commercial purse seining and trends of future improvements	Torban, S. S.
	67	Application of drum seining in the Californian wetfish fishery	Hester, F. J.
	68	The W.F.A. Acoustic Telemetry System	Allison, E.
	69*	Searching and catching tactics for tuna purse seining	Lênier, R.
	70	Present status of echo sounding and sonar and their application in Japanese fisheries	Nishimura, M.
	71	Improved handling of trawl gear	Traubenberg, G. A.
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	73	Methods of discovering and assessing fish concentrations	Judovitch, Y. B.
	74*	A high opening bottom trawl for inshore fisheries	Nédélec, C.
	75	Development and testing of the hybrid tuna purse seine	Green, R. E. Jurkovich, J. Petrich, B. P.
	76	Method of achieving optimum trawling operation	Freedman, A. L.
	77	The present state of hydroacoustic fish finding and instrumented gear control in purse seining and trawling	Kudryavtsev, V. I.
	78	Fish detection through aerial surveillance	Bunigno, J. A.
	79	Forecasting purse seine fishing conditions in the East China Sea	Ura, E. Mori, J.
	80	Trawl gear selection, design and construction in relation to fish behaviour, vessel power and fishing conditions	Dickson, W.

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* abstract only in English

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	83	Technological aspects of the modern Norwegian purse seine fisheries	Hamre, J. Nakken, O.
	84	Sector-scanning sonar used for observing deep-sea trawling	Margetts, A. R.
	85	The future of fisheries	Wilimovsky, N. J. Alverson, D. L.
	86	The American tuna purse seine fishery	Green, R. E. Perrin, W. F. Petrich, B. P.
	87	Results of some basic calculations of vessel and gear tracks, and of fish interceptions, in aimed trawling	Crewe, P. R. Dickson, W. Chaplin, P. D.

APPENDIX IV

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